Risk Management: Assignment 1

Financial Engineering

Hedging a Swaption Portfolio

Instructions

- **Delivery:** Friday 18:00 p.m. the 14th of March to financial.engineering.polimi@gmail.com, with subject "RM: Assignment 1, Group #";
- Deliver
  a. a **short** pdf document with the results (e.g. swaption strike, …). List the errors you've found.
  b. the code written in Python using your preferred IDE;
- Fill the gaps where appropriate and correct the errors (in case of incoherences between this document and the code, follow this document);
- Comment (in detail) the code and use explicative variable names;
- Use the data and the curve bootstrapped during the Risk Management: Assignment 0.

Case study

The IR-derivative desk of Polimi Bank has the following positions opened today (31/01/2023):

- Long swaption receiver 1m&10y 5y ATM – Notional €700 Mln;
- Vanilla 10y IRS fixed rate payer – Notional €600 Mln.

For both instruments, the floating rate is the 3-month Euribor (Q/Q, ACT/360 day count convention with a modified-following adjustment rule); the fixed rate has an annual 30/360-European day count convention mod-foll.

Questions

1. Mark-to-Market (MtM) the portfolio at the mid-rate curve;
2. Evaluate the portfolio DV01-parallel (hereinafter DV01);
3. Estimate the portfolio DV01 via an analytical approximation (e.g. using the swaption Δ and the DU of the fixed rate bond "corresponding" to the IRS). Discuss the difference, if any, with one obtained at the previous point;
4. Delta-hedge the portfolio with a 10y IRS, considering that an IRS is negotiated between institutional investors in multiples of €1Mln. What would be the hedge if you consider the approximated DV01?
5. Evaluate the portfolio coarse-grained bucket DV01 with coarse-grained buckets 10y and 15y;
6. Delta-hedge the portfolio with two liquid IRS (i.e. among the ones used for the bootstrap). Select them and justify your choice; evaluate the portfolio bucket DV01 using the same coarse-grained buckets of previous point;
7. Consider a curve steepening scenario (- 1bp for the 10y IRS rate and + 1bp for the 15y IRS rate). Evaluate Profit and Loss (P&L) for the portfolio built following the hedging strategy
   a. with only a 10y IRS (point 4) and
   b. with two IRS (point 6);
   Discuss which is the best hedging strategy among the two. Can you develop even more accurate hedging strategies using bucket-DV01s? Which are the pros and cons?